

Appl. No. 10/538,284

Amendment dated: April 17, 2009

Reply to OA of: November 17, 2008

REMARKS

At the outset, Applicants thank the Examiner for the review and consideration of the pending Office Action. The Office Action dated November 17, 2008 has been considered and its contents reviewed. Applicants request reconsideration of the Examiner's position in view of the following remarks.

1. Status of Claims.

No claims are hereby amended. No claims are hereby cancelled and no claims are hereby newly added. Claims 1-13 remain pending.

2. Examiner Interview.

Applicants are in receipt of the Examiner's Interview Summary of November 17, 2008. As previously noted, in the Response and Request for Continued Examination filed September 3, 2008, the interview was conducted by telephone on July 21, 2008. The participants were Examiner Johnston and Applicants' representative, Jeanne A. Di Grazio.

During the interview, the rejections of record and prior art were discussed. The Examiner also notes that the Examiner's interpretation of the hollow beam aperture in the Suzuki reference was discussed.

3. Claims 1-13 are rejected under 35 U.S.C. §103(a) as unpatentable over Keese (United States patent 5,627,373) in view of Chang (United States patent 6,288,401 B1).

Applicants have carefully considered the combination of Keese and Chang and most respectfully traverse the Examiner's rejections of claims 1-13.

The combination of Keese and Chang fails to teach or suggest all of the claim limitations and therefore the combination of Keese and Chang does not render the claimed invention *prima facie* obvious.

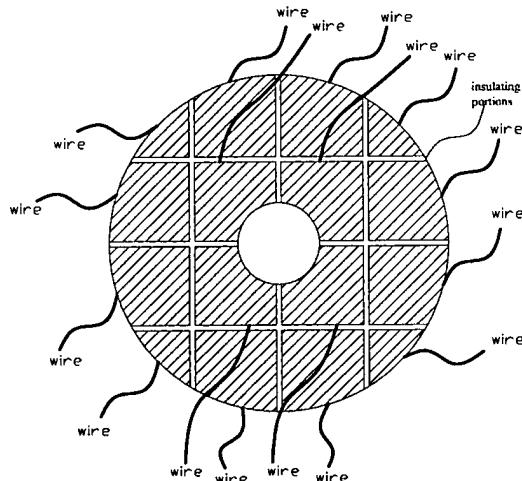
(a) The Claimed Invention.

The claimed invention is directed to measure the magnitude and the direction of the misalignment between the extractor aperture and the emitter. This data could be used for mechanical realignment of the emitter.

By way of illustration, the extractor of claim 1 comprises sensing regions (Figures 3 and 4, sensing regions 212) and insulating portions (Figure 3, insulating portion 213), wherein the magnitude and the direction of misalignment of an extractor aperture (Figures 3 and 4, extractor aperture 211) with an electron emitter (110) could be determined by *measuring and calculating the amount of electrons on each of the sensing regions.*

Therefore the extractor of the present invention could be used to inspect the amount of misalignment of an extractor aperture with an electron emitter in the micro-column.

By way of further illustration:



Referring to the above drawing, in the extractor of the claimed invention, *the arrangement of each sensing region is not dependent on the aperture of the extractor.*

Furthermore, if the sensing regions are increased, the magnitude and direction of the misalignment of the emitter with the extractor aperture can be measured more accurately.

In the claimed invention, a mechanical positioner, such as a piezoelectric stage, could be

Appl. No. 10/538,284

Amendment dated: April 17, 2009

Reply to OA of: November 17, 2008

installed in the micro-column to move the emitter for realignment of the emitter with the aperture of the extractor.

An aperture of an extractor in a micro-column is made for passing the electrons, and it is important to align an aperture with an emitter in a micro-column since the electro optics which affect the performance of a micro-column depend on the alignment between the aperture and the emitter.

The extractor as claimed in claim 1, gives information about the misalignment between the extractor and the emitter. The misalignment information is obtained from the amount of electrons which are irradiated on each sensing region in an extractor.

With respect to an electro-optic system, the mechanical alignment is better than the electro-static alignment in a micro-column. Therefore the extractor of the claimed invention provides the magnitude and the direction of the misalignment between the emitter and the extractor aperture, so that alignment between the emitter and the extractor aperture can be easily achieved with the micro-positioner.

(b) The Combination of Keese and Chang.

The combination of Keese and Chang fails to render the claimed invention *prima facie* obvious because the combination fails to teach or suggest all of the claim limitations.

Keese and Chang in combination fail to teach or suggest at least the claimed, magnitude and the direction of misalignment of an aperture of the extractor with an electron emitter of the micro-column is determined by measuring and calculating the amount of the electrons on each of the sensing regions.

Keese teaches only that the electron beam is *automatically* aligned to the objective lens axis with image processing of the edge of the aperture of a faraday cup (Keese, Col. 2, Lines 45-60).

Regarding Keese, a faraday cup is a metal (conductive) cup designed to catch charged particles in vacuum. The resulting current can be measured and used to determine the number of ions or electrons hitting the cup.

Keese fails to teach how to directly obtain the current data from an emitter in order to get the information regarding the magnitude and the direction of the misalignment between an

Appl. No. 10/538,284

Amendment dated: April 17, 2009

Reply to OA of: November 17, 2008

extractor and an emitter.

Turning to Chang, Chang teaches that a centering extraction electrode comprises four electrode elements which are separated by an insulating layer. However the voltages must be applied to electrode elements in order to change or deflect the path of the electron beam. Therefore electrode elements must be arranged around the aperture of the extractor and voltages have to be applied to the center of the electron beam.

Chang's centering extraction electrode is used *to reduce the difficulty of the mechanical alignment and to align the electron beam to the optical axis by means of changing the path of the electron beam* (electrostatic alignment).

The main problem in manufacturing an ordinary micro-column is the misalignment between the emitter and the aperture of the extractor electrode. However, it is very difficult to perform a precise mechanical alignment between emitter and extractor aperture using a positioner, as disclosed in Chang's, since the magnitude and the direction of misalignment cannot easily be measured precisely during the manufacturing process for a micro-column. Additionally, it is more difficult to perform a precise mechanical alignment during performing initial tests for the micro-column installed into a vacuum chamber. The initial test to confirm the proper function of a micro-column is performed by controlling the voltages applied to the emitter and each electrode of the electron lenses to acquire a standard specimen image. If the emitter and the extractor aperture are misaligned, an image of the standard specimen cannot be acquired.

Although, during the initial test, it is possible to physically move the emitter with a positioning device such as a piezoelectric stage, it is very difficult to realign the emitter to the extractor aperture in a micro-column installed in a vacuum chamber, since the magnitude and the direction of the misalignment of the emitter with the extractor aperture cannot be measured in the conventional micro-column.

Therefore, Chang teaches that the precise alignment between the emitter and the extractor aperture is achieved by changing the path of an electron beam with the centering extraction electrodes during processing the initial test or using a micro-column.

Although Figures 4 and 6 of Chang show the correction of the electron beam to the

Appl. No. 10/538,284

Amendment dated: April 17, 2009

Reply to OA of: November 17, 2008

optical axis, the correction must be performed after the mechanical pre-alignment. Therefore, if using the correction of Figures 4 and 6 in Chang, it is necessary to adjust the voltages applied to the electrode elements of the centering extractor electrode and to analyze the image of the standard specimen until achieving an optimized image of the standard specimen by much trial and error, and to determine the voltage value for each centering extraction electrode.

In conclusion, Chang fails to teach or suggest *how to measure the magnitude and the direction of the misalignment*.

Therefore, since Chang teaches only that a centering extraction electrode comprising four electrode elements which are separated by an insulating layer can change the path of an electron beam to correct the electron beam to the optical axis and Keese teaches only that the electron beam is automatically aligned to the objective lens axis with image processing of the edge of the aperture of a faraday cup used for testing the performance of a micro-column, one of ordinary skill in the art would not be led to the claimed invention which can determine the magnitude and the direction of misalignment of an extractor aperture with an electron emitter by measuring and calculating the amount of electrons on each of the sensing regions by the combination of Keese and Chang.

In addition, the claimed invention achieves the advantages of the magnitude and the direction of the misalignment between the extractor aperture and the emitter can be easily measured and mechanical alignment between an emitter and an extractor aperture can be achieved very effectively and precisely with the extractor of the claimed invention during the operating a micro-column.

Furthermore, there are important differences between the claimed invention and Keese and Chang and it is submitted that these differences are not obvious in view of Keese and Chang:

To summarize these differences: arranging sensing regions of the extractor of the claimed invention does not depend on the aperture of the extractor, it is not necessary to apply voltages to the sensing regions of the extractor of the claimed invention, the extractor of the claimed invention can provide the magnitude and the direction of the misalignment and

Appl. No. 10/538,284
Amendment dated: April 17, 2009
Reply to OA of: November 17, 2008

the micro-column according to the claimed invention can have a better electro-optic system than those of combination of references.

(c) No Articulated Reasoning with Some Rational Underpinning for the Modification of Keese in view of Chang.

In addition to the above arguments, it is most respectfully submitted that the Examiner has not provided any articulated reasoning with some rational underpinning for the modification of Keese in view of Chang.

In rejecting at least claim 1, the Examiner states, “it would have been obvious to one of ordinary skill in the art that Keese would use extraction and centering potentials superimposed on the split quadrupole extractor of Chang to provide a field emission source that produces a charged particle beam aligned with the optical axis. See Abstract. (Office Action at page 4).”

In view of *KSR* it is now clear that a *prima facie* case for obviousness does not require “motivation” in the form of an express teaching in the references themselves. However, *KSR* also stated that the legal conclusion of obviousness requires:

“an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.” [82 USPQ at 1396]

Further, *KSR* cited with approval, 82 USPQ at 1396, the following statement from *In re Khan*, 78 USPQ 1329 (Fed. Cir. 2006):

“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”

Thus, in making a rejection for obviousness, the burden remains on the Examiner to present “articulated reasoning with some rational underpinning” for the combination or modification which bridges the differences between the claimed invention and the prior art.

It appears as if the Examiner is proposing to modify Chang in view of Keese by superimposing Keese’s extraction and centering potentials onto the split quadrupole extractor of Chang as opposed to modifying Keese in view of Chang.

Appl. No. 10/538,284
Amendment dated: April 17, 2009
Reply to OA of: November 17, 2008

As already noted, Keese teaches only that the electron beam is *automatically* aligned to the objective lens axis with image processing of the edge of the aperture of a faraday cup. It is therefore not clear why one of ordinary skill in the art would want to modify an electron beam that is *automatically* aligned to the objective lens axis with image processing of the edge of the aperture of a faraday cup with that of a centering extraction electrode comprising four electrode elements which are separated by an insulating layer to change the path of an electron beam to correct the electron beam to the optical axis.

The modification of Keese in view of Chang would likely increase the complexity and difficulty of mechanical alignment. Furthermore, since Keese teaches an automatic alignment, any further corrections or alignments in Keese seem unnecessary. Therefore, as best understood, it appears as if one of ordinary skill in the art would be led away from the claimed invention by the combination of Keese and Chang.

Furthermore, there is no articulated reasoning with some rational underpinning for the modification of Chang in view of Keese, since, such a modification of Chang would likely render Chang unfit for its intended purpose.

Therefore, Applicants maintain that the combination of Keese and Chang does not render the claimed invention *prima facie* obvious.

The Examiner's rejection of claims 1-5 and 12-13 should be withdrawn.

Furthermore, for the same reasons, the Examiner's rejections of claims 6-8, 9, and 10-11 should also be withdrawn.

(d) Invention Must be Considered as a Whole.

The Examiner is urged to consider the invention as a whole and is reminded of the MPEP §2141.02 which instructs, “[i]n determining the differences between the prior art and the claims, the question under 35 U.S.C. 103(a) is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. . . .”

Therefore, considering the invention as a whole as the Examiner must, the claimed invention is not rendered *prima facie* obvious over the combination of Keese in view of Chang or Chang in view of Keese.

Appl. No. 10/538,284
Amendment dated: April 17, 2009
Reply to OA of: November 17, 2009

4. Conclusion.

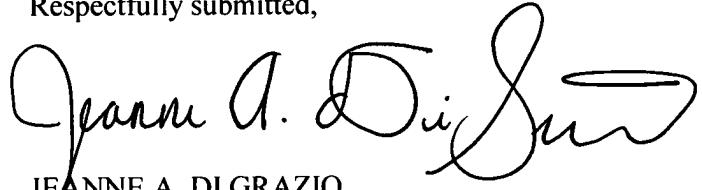
In view of the above remarks, favorable reconsideration and allowance of all the claims now present in the application are most respectfully requested.

If any issues remain that may be resolved by a telephone or facsimile communication with the Applicant's attorney, the Examiner is invited to contact the undersigned at the numbers shown below.

BACON & THOMAS, PLLC
625 Slaters Lane, Fourth Floor
Alexandria, Virginia 22314-1176
Phone: (703) 683-0500
Facsimile: (703) 683-1080

Date: April 17, 2009

Respectfully submitted,



JEANNE A. DI GRAZIO
Attorney for Applicant
Registration No. 58,633